State of California • State and Consumer Services Agency • Gray Davis, Governor
DEPARTMENT OF GENERAL SERVICES
Executive Office • 1325 J Street, Suite 1910 • Sacramento, California 95814-2928 • (916) 445-4145

April 23, 2001

The Honorable Steve Peace, Chair
Joint Legislative Budget Committee
State Capitol, Room 3060
Sacramento, CA 95814

Dear Senator Peace:

Enclosed is the Public-Safety Radio Integrated Systems Management (PRISM) report, as required by the Supplemental Report of the 2000 Budget Act, Item 1760-001-0666, #3.

If you have any questions or require additional information, please contact Barry Hemphill, Deputy Director, Telecommunications Division, Department of General Services, at (916) 657-9428.

Very truly yours,

Barry D. Keene, Director
Department of General Services

BDK:BH:CLS:GG:RH:mm\information dissemination\prism 1 scoop.doc

Enclosure

cc: See attached Supplemental Report List #2
Barry Hemphill, Deputy Director, Telecommunications Division, Department of General Services

SUPPLEMENTAL REPORT LIST #2
LEGISLATIVE REPORT LISTING

ORIGINAL LETTER TO EACH OF THE FOLLOWING:

The Honorable Steve Peace, Chair
Joint Legislative Budget Committee
State Capitol, Room 3060
Sacramento, CA 95814
(1 original + 17 copies)

The Honorable Steve Peace, Chair
Senate Budget & Fiscal Review Committee
State Capitol, Room 5019
Sacramento, CA 95814
(1 original)

The Honorable Tony Cardenas, Chair
Assembly Budget Committee
State Capitol, Room 6026
Sacramento, CA 95814
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Mr. Gregory Palmer Schmidt
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Mr. E. Dotson Wilson
Chief Clerk of the Assembly
State Capitol, Room 3196, E-24
Sacramento, CA 95814
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COPY OF JLBC LETTER TO EACH OF THE FOLLOWING:

The Honorable Tony Cardenas, Vice Chair
Joint Legislative Budget Committee
State Capitol, Room 6026
Sacramento, CA 95814
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The Honorable Jim Battin, Vice Chair
Senate Appropriations Committee
State Capitol, Room 3076
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The Honorable Patricia Bates, Vice Chair
Assembly Appropriations Committee
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The Honorable Dick Ackerman, Vice Chair
Senate Budget & Fiscal Review Committee
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The Honorable George Runner, Vice Chair
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SUPPLEMENTAL REPORT--REVISED 04/30/01

STATUS REPORT TO THE LEGISLATURE

REGARDING THE

PUBLIC-SAFETY RADIO INTEGRATED SYSTEMS MANAGEMENT

(PRISM) PROJECT

SUBMITTED

BY THE

DEPARTMENT OF GENERAL SERVICES

APRIL 1, 2001

This report was prepared pursuant to Supplemental Budget Language for the 2000-2001 Fiscal Year Budget Act Item 1760-001-0666, #3, that reads as follows:

"Public-Safety Radio Integrated Systems Management (PRISM). The Department of General Services (DGS) shall, by April 1, 2001, provide a status report to the chairs of the budget committees in each house and the Chair of the Joint Legislative Budget Committee detailing the status of the implementation of the Public Safety Radio Integrated Systems Management (PRISM). The status report shall include, to the extent possible, a description of the PRISM accomplishments to date; changes in implementation strategies as a result of the network design and engineering progress, advances in new radio technologies, and spectrum/frequency availability; proposed activities and equipment purchases over the next 12 months; a description of any changes in the long term PRISM funding needs for both the current public safety radio system and the proposed PRISM system as a result of the changes in the implementation strategies; a discussion of federal funding opportunities; and a PRISM cost breakdown. The PRISM cost breakdown shall display budgeted costs by previous years costs, current year costs, budget year costs and remaining costs. These costs shall be broken down into the following categories: The DGS staff costs, including the number of personnel years (PYs), existing systems costs, PRISM equipment costs, consulting services costs, and other costs."

INTRODUCTION

California's state public safety agencies' radio communications systems are crippled by a lack of interoperability, channel congestion, aging equipment, inadequate funding, and limited functionality. Without effective and reliable radio communications, the citizens of California, and those sworn to protect them, are increasingly placed at risk.

Faced with this situation, the state's ten largest public safety departments, together with the DGS, Telecommunications Division (DGS-TD) formed a partnership to develop a cohesive, cost-effective strategy for improved public safety communications. The **Public-Safety Radio Integrated Systems Management (PRISM)** project is the result of over six years of intensive planning efforts focusing on the development of the most effective technology and organizational approaches to meet the participating agencies' combined needs.

PROBLEM STATEMENT

California's state public safety departments are in dire need of improved field communications capabilities. Existing systems fail to meet current user needs and are unable to support future requirements. These aging systems are increasingly jeopardizing the safety of both citizens and field personnel. Current problems are summarized below.

Lack of Interoperability

State public safety departments lack the ability to communicate effectively with each other and with federal and local public safety agencies. Currently, the state's public safety departments operate in every available frequency band allocated for public safety use. Radio users in one band cannot talk to users operating in a different band. As a result, communication among state agencies, and sometimes among different divisions within the same agency, can be severely restricted. The increasing complexity, size, and frequency of disasters and emergency incidents are escalating the requirements for coordinated multi-agency response among different levels of government.

For example, the Yuba County Sheriff's Department personnel, local Search and Rescue (SAR) and Urban Search and Rescue (USAR) teams; the California Department of Fish and Game (DFG); the California Department of Forestry (CDF); and local fire departments all required mutual aid communications during the recent floods in 1997. Coordinating these search operations required three separate radios. Some of the teams went into the flooded areas on assignment without communications with the Command Post, potentially losing their lifeline. The lack of direct communications capability also caused multiple teams to search the same submerged houses, delaying response to other citizens in need, and unnecessarily putting state personnel into hazardous situations.

During the Loma Prieta and Northridge earthquakes, the recent wildland fire in San Diego County, and the recent semi-trailer crash into the State Capitol, communications problems were experienced between and among the responding agencies.

Channel Congestion

Congestion on existing voice radio systems often leaves field personnel waiting several minutes to access an available channel. The state's public safety departments are currently operating near, and in some cases exceeding, capacity of their existing radio communications systems. Radio spectrum allocated for public safety in the VHF, UHF, and 800 MHz bands has been fully assigned in most urban areas of California; there are no additional channels currently available.

When the nation's worst firestorm in almost a century raged in Berkeley and Oakland Hills in 1991, firefighters from more than 50 federal, state, and local agencies joined to battle the blazes. At the height of the fires, radio communications was often impossible. Congestion caused by too many radio units on the same few available channels jammed communications. As a result, communications among cooperating agencies was often limited to face-to-face interaction. The Oakland Hills fire took 25 lives, injured 150 persons, destroyed 3,000 homes, and exceeded $1 billion in losses.

Aging Equipment

Antiquated systems and aging equipment inventories translates into escalating maintenance costs and reduced reliability. The majority of the state's existing radio communications systems rely on 30-year old technology. Much of the infrastructure was installed over ten years ago, and over 50 percent of the state's 43,000 user radios are at or near the end of their useful life.

The California Highway Patrol's (CHP) existing radio communications system is facing imminent obsolescence. The department can no longer obtain radio equipment from major manufacturers. Loss of vendor support will impact the CHP's ability to provide even the most basic radio communications between officers and dispatchers in the next few years.

Limited Functionality

The lack of commonly available mobile data communications and video transmission capabilities in the field significantly impairs the effectiveness and safety of public safety personnel during routine and disaster situations. Advances in field data, remote sensors, and video communications technologies are providing a wealth of new capabilities and applications that can substantially aid public safety personnel in performing their duties.

On January 17, 1994, one of the nation's most damaging earthquakes since 1906 hit the San Fernando Valley. The most significant incident, in terms of loss of life associated with this catastrophe, occurred when a three story, 120-unit apartment complex collapsed. Involved in the rescue operations were USAR teams from several counties and the Governor's Office of Emergency Services. Advanced field communications technologies could have aided this and similar efforts in the affected areas by making floor plans, resource lists, damage assessments, and other critical information instantly available on-scene. As the obsolescence of radio communications systems across the state continues for the majority of agencies, the safety of field personnel and their ability to provide service to the public during emergency and routine operations is increasingly jeopardized.

Narrow Window of Opportunity

The Federal Communications Commission (FCC) recently completed proceedings that outline the approach for the newest public safety spectrum allocation. This spectrum allocation, in the 746–806 MHz band (previously Television Channels 60–69), will alleviate some channel congestion problems for agencies that have the resources and organization to rapidly pursue licensing. Spectrum is a desperately needed resource that is licensed on a first-come, first-served basis. The licensing process favors agencies that can prove cooperative use of the requested frequencies, show the financial resources necessary to implement shared systems, and demonstrate the organizational structure to fairly govern the spectrum's use. The state must position itself to take advantage of this most recent, as well as other, spectrum allocations.

BACKGROUND

California's public safety departments provide a wide range of public services including law enforcement, fire protection, disaster response, transportation management, flood control, criminal detention and rehabilitation, search and rescue, and other services to over 33 million residents and 44 million visitors to the state each year. In order to effectively and responsively provide these services, the state's public safety departments require immediate field access to information such as "wants and warrants," vehicle registration, weather, terrain access, missing persons, and gun registration. For the over 43,000 state public safety employees involved with field operations, mobile radio communications is the primary, and sometimes only, link to this information and additional resources during both routine and emergency operations.

Recognizing the need to improve the existing radio systems and to enhance functionality and interoperability, the Public Safety Radio Strategic Planning Committee was established in December 1994. The Committee's goal was to develop a vision for public safety radio communications built upon collaborative efforts and shared successes.

The eleven state departments that have joined together as the Public Safety Radio Strategic Planning Committee include:

- Department of California Highway Patrol

- Department of Corrections
- Department of Fish and Game
- Department of Forestry and Fire Protection
- Department of Justice
- Department of Parks and Recreation
- Department of Transportation
- Department of Water Resources
- Department of the Youth Authority
- Office of Emergency Services
- Emergency Medical Services Authority (participating under a grant from the Office of Traffic Safety)

An additional key stakeholder of the state is the DGS which is responsible for developing and maintaining the systems that meet the needs of these participating agencies.

To facilitate the accomplishment of its goals, the State of California engaged consultants to assess the state's current radio communications systems, evaluate existing and emerging technologies, and guide the departments in the preparation and delivery of a strategic plan. *Partnering for the Future: A Strategic Plan for California's Public Safety Radio Communications* was published in January 1997.

One of the first steps toward the implementation of the Strategic Plan was to complete a Cost Benefit Analysis (CBA). The CBA, which was published in April 1999, contains: the requirements for the radio systems; an analysis of the alternatives, including preliminary costs and associated benefits; a conceptual model of the proposed systems design; and an implementation plan outlining the required steps and timetable to proceed.

The CBA analysis focused on three primary alternatives for meeting the collective agencies needs for field voice and data communications.

1. ***Maintain Status Quo:*** This assumes that the state departments would maintain existing systems and make no further investments in capital improvements to the systems.
2. ***Pursue Agency Independent Initiatives:*** This alternative assumes that the state departments would pursue the acquisition of systems that support their unique needs. They would do so independent of what other departments may or may not be doing to enhance their own communications systems.
3. ***Pursue Shared Infrastructure:*** This alternative assumes that the state departments would pursue the acquisition of a shared radio infrastructure to support their unique needs in partnership with other state departments.

ACCOMPLISHMENTS TO DATE

Summary:

Concurrent efforts continue in support of the PRISM pilot project. Efforts underway include:

- Governmental development required within the Project Definition Phase;
- Evolution of the requirements compliance matrix based upon agency-provided Functional and Operational Requirements;
- Acquisition and evaluation of any additionally required traffic load information;
- Pursuit of statewide spectrum to accommodate this effort;
- Refinement of the participating agencies site acquisition and development process; and
- Identification and exploration of all reasonable system alternatives.

Specific accomplishments to date include the following:

- The PRISM Pilot Project Plan (141 pages):

  The plan will be updated throughout the life of the project and is flexible by design. The plan will evolve as more defining data becomes available. This plan, formally accepted by the PRISM Strategic Planning Committee (the consortium of eleven state agencies) on December 4, 2000, was baselined on January 8, 2001. Upon publication, this plan included:

  - Cost information;
  - Salient project specifics;
  - Preliminary agency mobile and portable radio counts;
  - Preliminary agency console position, control station, and secondary fixed and portable coordination transceiver locations and counts;
  - A task list comprised of 1,146 activities associated with the PRISM pilot project;
  - Proposed schedule associated with each of the 1,146 activities; and
  - The Gantt chart representation for all 1,146 activities spanning the years 2000 through 2004.
- Received and entered 85 percent of the participating agencies' inputs required to complete the functional and operational requirements definition.
- Facilitated data collection processes for radio traffic loading and busy hour information. Traffic load analyses will continue to be refined throughout the life of the project to track trends and anomalies.
- Finalized participating agencies' mobile and portable radio counts for the pilot area.
- Finalized participating agencies' console position, control station, and secondary fixed and portable coordination transceiver locations and counts.

- Compiled draft minimum criteria regarding site preparation requirements.
- VHF High Band coverage modeling preliminary site selections completed; final site selections are due by 06/30/01.
- Preliminary UHF coverage modeling underway with preliminary site selections due by 3/30/01, and final site selections due by 06/30/01.
- Initial staffing (delayed due to recruiting difficulties) conducted in mid-November resulted in three limited term Associate Telecommunications Engineering positions being filled.
- Active participation in meetings and working groups in Southern California with Region #5 Regional Planning Committee to establish the state's position relative to the critical 700 MHz frequency band plan. Partially because of State of California involvement on both the state level and on a national level, one hundred ninety two 6.25 kHz channel pairs of spectrum have been allocated for statewide use in all states. Due to California's population density, however, a demand for more than that number is anticipated. The state's presence at these formative meetings is therefore critical to the program and the project's outcome.
- Technological alternatives analyses for a number of technologies and vendor solutions is underway having resulted in many dialogues and forums taking place. Project-related dialogues and/or forums to date have been held with representatives from a diversity of sources including:
  - Motorola
  - Nokia
  - Interoperability Wireless
  - ComNet Ericsson
  - M/A-Com Wireless Systems
  - Science Applications International Corporation
  - Aerospace Corporation
  - Office of Traffic Safety (OTS)
  - Communications representatives within the:
    - State of Pennsylvania
    - State of New York
    - State of Florida
    - State of Arizona
    - State of Nevada
    - State of Texas
  - U.S. Navy Research Labs
  - U.S. Navy Federal Fire

- National Institute of Justice (NIJ)
- Federal Bureau of Investigation (FBI)
- Bureau of Land Management (BLM)
- National Law Enforcement Corrections and Technology Center (NLECTC)

- Revised the engineering estimates for the PRISM pilot project to reflect the participating agencies' inputs.

CHANGES TO IMPLEMENTATION STRATEGY

Pilot Project Scope Finalization

The Steering Committee has finalized the scope of the pilot project.

ADVANCES IN NEW RADIO TECHNOLOGIES AND SPECTRUM / FREQUENCY AVAILABILITY

The technical challenge in the PRISM network design is to build a system that will serve all of the participating agencies' requirements and provide interoperability when necessary. Additionally, such a system should be upgradeable for all users during its life expectancy (30 years). This will be an on-going process. The design will evaluate the cost and benefits of applicable available technologies and monitor developments in related promising technologies.

Several technologies were reviewed and determined not suitable for the primary system. For example, commercially available systems do not provide acceptable coverage outside well-populated areas or major travel routes. Such coverage may be used for some agencies, but it may not be used to support the primary system.

Satellite service at this time is lacking the dispatch capability required by some of the major public safety agencies. Additionally, there is concern with the viability of the service in light of the failure of the Iridium system and the pending bankruptcy of the Globalstar system.

Conventional analog radio systems were also considered, but the life expectancy of the technology is limited. Some analog radio support has already been discontinued, and at this time, it seems to be a trend. PRISM cannot use analog technologies and meet its life expectancy.

Some technologies (e.g., digital radios) were determined to be a requirement. Digital systems inherently provide more reliable communications coverage, more efficient use of the frequency spectrum, and are capable of integrating voice and data. All the new and foreseeable future developments in wireless communications require digital technology.

A trunked radio system is also required since PRISM will be a network shared by several agencies. Such a system allows access of all available channels to all users on a first come, first serve basis or on a priority basis when required. A trunked system provides economies of scale in both cost and spectrum usage. Presently, most agencies have their own frequencies and radio systems but share radio vaults and radio towers. The FCC frequency spectrum bandwidth allocations are becoming more stringent. This creates a situation where the number of available frequencies is limited and, unless centrally managed, the possibility for radio interference is increased. A centrally managed trunked system will minimize the possibility of radio interference and will require fewer frequency channels.

A future major evaluation will assess the feasibility of voice and data integration. The functionality of an integrated system has not been completely proven and vendors of integrated systems do not use open standards. Vendors require proprietary equipment and software throughout their systems to achieve full functionality. PRISM should be based on open standards whenever possible so that it may achieve projected life expectancy without depending on a single vendor. At this time, we are still evaluating the advantages and disadvantages of available integrated and non-integrated systems.

There are also technologies on the horizon that have not yet been proven dependable but should be monitored for the length of the project in the event that use of them may be cost effective and advantageous to the success of PRISM.

The PRISM Project is planning to use open system standards, if they exist, as long as required functionality is not compromised. Compatible equipment will be tested and identified as it becomes available. Assuming standards are used, there are five basic functional areas for which equipment may be purchased: End User Interface, Transceiver, Network Facilities, Switches/Routers, and Network Management. The equipment in each of these areas may be provided from a different vendor so long as common standards allow it to behave as a system.

The End User Interface equipment includes mobile radios (voice and data), Mobile Data Computers (MDCs), hand-held radios, enhanced pagers, video cameras, and any other appliance that provides access to people or data through the PRISM network. The equipment will be digital, but there are several technologies to evaluate in this area. Equipment in a vehicle will need to support Automatic Vehicle Location (AVL).

Presently, the integration of voice and data in a single radio is available, but its data bandwidth is limited and may not be enough for some applications. The pilot project will test separate radio systems for voice and data. All of the appliances will need to be at least Project 25 Phase I compliant. Other promising technologies that might be used to access the PRISM Network are the Project 25 Phase II and Terrestrial Trunked Radio (TETRA). In a portable-to-portable or car-to-car environment, Bluetooth is a new wireless technology that shows potential and will be evaluated.

The Transceiver devices are the base stations, repeaters, satellite, or building installed systems that communicate with the end user equipment. Transceivers will signal the end user equipment which channel is available, accept the digital transmission, and transmit it along an available trunk. Trunked radios are necessary to effectively share the frequency spectrum and minimize the number of trunks. The transceiver has to match end user equipment functions. We will continue to evaluate the availability of trunked radio transceivers, with or without voice and data integration, which support Project 25 Phase I, Project 25 Phase II, or TETRA. Both satellite and cellular technology have been evaluated, but at this time they are not effective except in selected situations.

The Switching or Routing Center devices are located regionally. Using network facilities, they receive the voice and data traffic from a group of radio transceiver sites and switch the traffic to the appropriate dispatch center, or using a gateway, route data/voice to the required application. This equipment may or may not be voice/data/video integrated. If equipment manufacturers will use the new type of Internet Protocol, the ability to integrate the traffic and share the network facilities will be enhanced. Additionally, the designed capacity of the chosen equipment will, in large part, determine the network design.

The Network Facilities provide the physical infrastructure in support of the different parts of the PRISM network. Network facilities include vaults, towers, microwave radios, and landlines. Required bandwidth and access to the site will determine which carrier technology is used.

The Network Management Center or Equipment will be a central location where all PRISM network equipment will be inventoried, monitored and managed. In this operation center, technicians will use network management workstations and software to identify chronic problems and ensure the network operates at the desired quality of service. Additionally, the collected data may be used to independently verify the vendor service level agreement claims and require rebates when appropriate.

Specific Technology Review

End User

- ***Analog signal technology radio:*** This uses a nominally continuous electrical signal to modulate voice energy in electrical signals. The audio frequency of the electrical signal is then stepped up to the carrier frequency and broadcast via an antenna throughout a line of sight area. It is a proven technology, but it is susceptible to environmental noise. The earliest radios were designed to transmit analog signals. Today's radio manufacturers have started to discontinue the manufacturing of analog radios—a trend that is likely to continue for the foreseeable future.
- ***Digital signal technology radio:*** This communications system uses digital signals in the sending and receiving of messages. A time-varying or spatial signal, such as sound or visual images, is sampled and the values then represented as sequences or arrays of digitized samples; this is known as digital signal processing**.** This digitized data is then applied to the carrier frequency by a process of varying one or more parameters of the carrier wave as a function of two or more finite and discrete states of a signal. This stream of digital bits is then transmitted over the radio network and reconstructed at the receiving end as the audible sound. All newly manufactured radios and associated features utilize digital technology.
- ***Cellular telephone:*** A mobile communications facility having radio transmission and telephone switching capabilities that provide communication between users. This technique utilizes lower-power sites and directional antennas that are designed to provide coverage over a small area (or cell); thus, it can reuse mobile frequencies in nonadjacent geographical areas or cells to greatly expand total system capacity. This technology is available from vendors in metropolitan areas but does not provide the necessary coverage for PRISM. Additionally, the relatively small coverage area of each cell would require so many more antenna sites that it would make the cost of the system prohibitive.

- ***Enhanced paging:*** Enhanced paging provides one-way data transmissions to a radio receiver. Both alphanumeric text and binary data, such as images, can be supported by this technology. Some newer enhanced paging technologies provide for short reply message capabilities.
- ***Automatic vehicle location device (AVL):*** AVL typically provides a graphical representation of a vehicle location at a dispatch center. This is accomplished via a sensor installed on a vehicle that calculates the vehicle's position and then transmits the information where needed through a wireless data network between the vehicle and the fixed location. The vehicle's position may also be presented to the driver and passengers on an in-vehicle map display or laptop computer.
- ***Bluetooth appliance:*** A global de-facto standard for wireless connectivity based on a low cost, short-range radio link. Bluetooth uses a radio-based link that does not require a line-of-sight connection in order to communicate. A mobile data computer could send information to a printer in a nearby building, or a hand-held radio when away from a vehicle.

Transceiver

- ***Analog signal technology base station transceiver:*** Operates with analog radios by transmitting received information on an analog carrier frequency or landline to a central location. It is a proven technology, but it is susceptible to environmental noise. The earliest transceivers were designed to transmit analog signals. Today's manufacturers have started to discontinue the manufacturing of analog transceivers—a trend that is likely to continue for the foreseeable future.
- ***Digital signal technology base station transceiver:*** Operates with digital radios by transmitting received information on a carrier wave as a function of two or more finite and discrete states of signals. This stream of digital bits may also be transmitted over a microwave network or landlines. All newly manufactured transceivers and associated features utilize digital technology.
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- ***Enhanced paging:*** Enhanced paging provides one-way data transmissions to a radio receiver. Both alphanumeric text and binary data (e.g., images) can be supported by this technology. Some newer enhanced paging technologies provide for short reply message capabilities.
- ***Conventional radio transceiver:*** The oldest, and currently the most prevalent, form of wireless communications. These are radio systems that are designed based on discreet frequencies dedicated to specific communications channels. A single frequency

(or frequency pair for duplex communications) equates to only one usable channel. In a specific geographical region, when a user is transmitting on that channel, no other users have system access on that channel until the initial user stops transmitting.

- ***Trunked radio:*** "Trunking" refers to radio systems that are designed so that users "draw" a channel from a pool of licensed frequencies at a fixed site. This is similar to a voice telephone Private Branch Exchange (PBX) system where both outbound and inbound lines are shared among telephone sets. All users assigned to the system have access to all of the channels licensed by the owner of the system. When a user acquires a channel to transmit a message, only that channel becomes unavailable to other system users for the duration of the transmission. Other channels that are part of the pool, however, are still available for use.
- ***Satellite communications:*** Two types of satellite systems offer mobile communications services: Geo-stationary (GEO) and Low Earth Orbit (LEO). The GEO satellites remain in a fixed position 22,300 miles above the earth. The GEO satellites have been in service for a number of years, but signals are delayed by the 44,600-mile round trip. The LEO satellites are placed in orbit between 300 to 700 miles above the earth's surface.

Network Facilities

- ***Specialized Mobile Radio (SMR):*** An SMR is a specially licensed private enterprise that has established a dedicated radio system and who markets land mobile communications services on a fee-for-service basis.
- ***Dedicated mobile data network:*** A dedicated mobile data network is designed to meet the wireless data access needs between mobile units and fixed host computer systems. These networks are typically implemented in parallel with a voice radio communications system and provide coverage in the same area as the voice system. These systems generally use conventional or trunking radio system technology. Dedicated mobile data networks are typically utilized for higher volume data application requirements or to support large numbers of users.
- ***Integrated voice and data network:*** An integrated voice and data network uses the same radio communications equipment for both user equipment and fixed system equipment to transmit and receive both voice and data signals. This is accomplished by digitizing the analog voice message and interleaving it with a data message or by supporting separate transmissions for voice and data messages. Depending on the particular technology selected, this approach offers advantages when supporting small numbers of users and a lower volume of data transaction requirements. Most integrated voice and data systems use trunking technology.
- ***Circuit switched cellular:*** Uses the existing cellular telephone networks for data transmissions. Essentially, a radio modem is attached to the mobile computer and a dial-up session is established with the host computer. This approach incurs a delay in the transmission of information while the telephone call is established. Cellular data systems are limited by the same constraints associated with "regular" cellular telephones (e.g., loss of signal when traveling through a tunnel or when out of range of a cellular site).

- ***Cellular digital packet data (CDPD):*** Uses a dedicated channel in the cellular network to transfer data. Discrete "packets" of data are transmitted over the network and reassembled at the receiving device. The CDPD capability requires a system upgrade to the existing cellular telephone network and is not generally available in the same areas as current cellular coverage; therefore, it is not a viable option for state public safety service use.
- ***Private packet radio networks:*** Commercially provided data transmission services supported by networks that are similar to the dedicated mobile data networks. Generally, these are proprietary networks with vendors differentiated by available transmission protocols, system coverage areas, and cost of service.
- ***Enhanced specialized mobile radio (ESMR):*** Essentially an SMR network using digital transmission technology. Since the voice messaging is digitized, data transmissions can be accommodated without additional interfaces and modems. The same fixed and user radio equipment is used for both voice and data transmission requirements. Several ESMR providers offer user equipment with integrated voice and data features as well as alphanumeric display and paging capabilities. This form of data transport does not support multi-agency interoperability.
- ***Personal communications systems (PCS):*** The next generation of terrestrial-based commercial wireless communications. The PCS system designs are based on "micro-cellular" coverage. Micro-cells are areas that are smaller than standard cellular telephone coverage areas and use low-power transceivers. Due to the transmission technologies utilized and the greater transceiver density, these services could potentially provide significantly greater data throughput.
- ***Satellite mobile data:*** Satellite mobile data communications use many GEO or future LEO providers to support mobile data transmissions. Satellite data system providers utilize both circuit switched and packet technologies.

Switching or Routing Centers

- ***Gateways:*** These are intelligent fixed system devices that allow communications between dissimilar systems. In the context of voice radio, this allows a user transmitting in the VHF High Band, for example, to transmit to users operating in the 800 MHz band. The gateway permits the receiver to hear the transmission without requiring the use of multiple band radios.

NETWORK MANAGEMENT CENTER OR EQUIPMENT

Voice Radio Technologies

- ***Conventional verses Trunked:*** Conventional technology cannot support many of the priority requirements identified by each agency. Examples of requirements not supported by conventional technology include both "call" and "unit" prioritization, flexibility of grouping of users, and granting immediate channel access. Trunking technology promotes system efficiency since fewer channels are required to support a greater number of users. Conventional and trunking systems can co-exist with portable and mobile equipment.

Conclusion: Trunking technology provides for the state's needs better although it is relatively expensive in low user-density areas where conventional systems may be installed instead.

- ***Trunked Channel Access Methods:*** There are three methods of providing shared channel access when operating in a trunked mode, each corresponding to proprietary technology. They are: TDMA, Time Division/Domain Multiple Access; FDMA, Frequency Division Multiple Access; and CDMA, Code Division Multiple Access. All three methods can be applied to the public safety environment and all three are capable of supporting requirements.

  Conclusion: Any channel access method is acceptable as long as it provides interoperability between agencies regardless of the equipment purchased and installed.

- ***Single Side-Band Radio (SSB):*** Supports almost all participating agencies' requirements; however, due to problems with signal reception in both the mobile and portable environments (due to low power transmissions), few agencies make use of this technology. Hence, it is unlikely that interoperability requirements can be satisfied using this technology.

  Conclusion: Single Side-Band radio technology does not meet the state's needs.

- ***Satellite Based Voice Mobile Communication:*** Data gathered during a recent Request for Information (RFI) sent to several satellite communications vendors indicates that satellite platforms are not currently viable alternatives for satisfying the state's primary public safety radio communications needs. The following identifies the key shortcomings of currently available GEO satellite systems:

  - No portable (i.e., hand-held) access;
  - Significant time delay between transmission and receipt of message;
  - Poor in-building coverage; and
  - Single point of failure (i.e., only one satellite, with no redundancy, to support all users).

  The LEO systems are being launched but cannot be considered a viable alternative for several years. Currently, of the eight vendors planning for LEO systems, none are positioning themselves to provide dispatch (one-to-many) capability. These new systems target the mobile telephone market and will provide wide-area "roaming" capabilities similar to a typical cellular telephone service. For example, one vendor is offering a dispatch service from a GEO platform, but the configuration lacks other capabilities to meet the state's requirements (such as system access with portable radios).

  Conclusion: Satellite communications are not a viable option for primary public safety communications at this time; however, their unique features make them a viable alternative for secondary and ad-hoc communications requirements.

- ***Cellular Telephone System Use:*** Cellular telephones do not satisfy the participating agencies' requirements for priority access and availability, and they cannot be considered as a primary means of voice communications for public safety agencies. They can, however, be a valuable backup to radio communications in areas where coverage permits their use. Cellular telephone coverage is comprehensive in most urban and many suburban areas but is currently limited in remote areas.

Conclusion: Continue use of cellular telephones as an adjunct to public safety radio communication capabilities.

- ***Specialized Mobile Radio Providers (SMRs):*** These providers supply a valuable service; however, they fall short when considering the requirements for providing interoperability and statewide coverage. The likelihood of other government users (federal, state, or local) operating on the same system provided by the SMR is not great; therefore, interoperability will suffer.

  Conclusion: The state should not pursue the use of SMRs for primary public safety voice radio communications.

Mobile Data Technologies

- ***Dedicated Mobile Data Network vs. Integrated Voice and Data Network:*** Integrated voice and data systems tend to operate less efficiently than dedicated systems because of the inefficiency of transporting data messages with voice messages. A dedicated data network will prove more cost effective since numerous fixed sites, vaults, and towers will already be established for voice communications systems.

  Conclusion: A dedicated mobile data network better suits the state's needs while simultaneously addressing system cost concerns.

- ***Circuit Switched Cellular (CSC):*** Circuit switched cellular has the disadvantage of longer set-up time because the data device must await connection through the cellular telephone public switched network. Immediate access to, or receipt of, information is delayed. Coverage for data uses mirrors for cellular telephone applications; and thus, is only available in urban areas and along major roadways.

  Conclusion: CSC is not a preferable means of data transport for the state, especially not for agencies that operate in rural or wild land areas.

- ***Cellular Digital Packet Data (CDPD):*** CDPD is slowly becoming more available across the nation as a means of transport for mobile data messages. Many vendors are beginning to offer fixed-rate contracts for public safety users; however, this technology is also supported by the cellular telephone network and may be affected by the same coverage limitations that affect switched cellular telephone services.

  Conclusion: CDPD is not a preferable means of data transport for the state.

- ***Private Packet Radio Network (PPRN):*** This technology demonstrates favorable performance characteristics for medium-bandwidth (e.g., image transmissions) public safety applications. As a privately-owned and run network, a vendor would also have direct responsibility for system maintenance and administration.

  Conclusion: PPRN is well suited to support state mobile data requirements where it is consistently available; however, availability is generally limited to areas of higher population density.

- ***Enhanced SMR (ESMR), Satellite Mobile Data, or Personal Communication System (PCS):*** ESMR has similar characteristics to an integrated voice and data system; thus, it is not a desirable means to support state requirements. Satellite data rates are typically slow, with most "patrol fleet" mounted mobile data systems only capable of up to 4800 baud. The PCS could be a viable means to address requirements for mobile data, but until vendors have finished building out their systems, exact costs and system coverage are not available for evaluation.

  Conclusion: The PCS-based mobile data communications may be a viable option in the future if coverage is available and it proves to be cost effective.

- ***Automatic Vehicle Location (AVL):*** A mature, stable product offering that can be integrated with each of the data transport technologies.

  Conclusion: The AVL should be implemented for all agencies.

SPECTRUM ISSUES

The DGS-TD has been carefully monitoring the developments regarding new radio spectrum that the FCC will be making available to public safety agencies. This new spectrum in the 700 MHz band represents the single largest grant of public safety spectrum in history. While providing a unique opportunity, it also presents unique challenges that include the vacating of that spectrum by television broadcasters in the UHF channels 60 through 69 by 2006.

The FCC, in its most recent rulings, continues to release the rules under which this spectrum can be used. It has required potential users of the new spectrum to meet with "Regional Planning Committees" (RPC) to coordinate the use of the spectrum and to make recommendations to the FCC and licensing bodies regarding the use of the spectrum. The DGS-TD, on behalf of the project, has been meeting with the RPC in Southern California regarding the needs of the state for that area. The Northern California RPC has also met, and the DGS-TD has communicated the state's needs to that group as well.

In October 2000, the FCC issued a Memorandum Order and Opinion that provided an unprecedented grant of 2.4MHz of this new spectrum to each state that, when applied for by the Governor, will be granted to the state for their exclusive use to build a statewide public safety system. Under the rules established by the FCC, the state must demonstrate that "…it is prepared to provide…" service to at least one third of the state residents by 2012.

In order to obtain this 2.4 MHz of spectrum, the Governor must apply to the FCC by December 31, 2001, and the DGS-TD is currently preparing that request. If the state does not apply for the spectrum, it will be released to the "general use" pool and the state will lose the majority of the spectrum we have determined that is necessary to build a statewide system.

PROPOSED ACTIVITIES AND EQUIPMENT PURCHASES OVER THE NEXT 12 MONTHS

System Life Cycle Summary Task Synopsis

The nominal duration listed below represents reasonable timeframes for the identified Acquisition Phases. Under Requirements Definition, we indicated we needed to establish and maintain a clear understanding of each participating agency's requirements, environments, and constraints. These criteria will influence the actual timeframes realizable.

Task ID #	Acquisition Phase	Purpose of Phase	Span of Phase
0	Project Initiation		7/3/00
3	Definition	Characterize PM organization; Establish inter-agency reporting relationships, Develop Chains of Command, et cetera	7/3/00–6/4/01
24	Planning	Develop and Baseline Scope, Schedule and Cost Set	7/3/00–1/8/01
51	Pre-implementation	Refine Requirements; Conceptual Studies; Investigation of Alternative Solutions	7/3/00–7/3/01
281		Concept(s) Selection	6/18/01
285	Implementation	Identify and Analyze Major System Alternatives (Concept Demonstration & Validation)	11/16/00–9/15/03
323		Site Selection, Acquisition, and Development	12/18/00–9/15/03
345		Spectrum Acquisition	7/2/01–9/15/03
408		Project Go Ahead	7/2/01
412	Full Scale Development	Establish Designs, Standards, and Terms & Conditions for Selected Systems Alternatives	7/2/01–7/3/02
471		Produce Design Documentation	8/22/01–7/3/02
472		Produce RFP(s) and/or RFQ(s)	4/2/02–7/3/02
480		Production Ratification	7/3/02
484	Production Development	Site and Systems Construction	6/27/01–9/30/04
526-536		Solicit Responses to RFP(s) and/or RFQ(s) through Wait Out Protest Period	7/5/02–2/19/03
537		Issue Notice(s) To Proceed (for Radio Systems)	2/19/03
538		Construct Sites, then Systems	6/27/01–7/14/04
586-791		Deploy Operating Capability	9/29/03–8/30/04
1142	Operation & Support	User Support Modifications & Product Improvements	9/29/03–7/1/19
1172	Life Cycle Complete		7/1/19

CHANGES IN LONG-TERM PRISM FUNDING

- Projected long term funding requirements for the PRISM Project continue at the originally estimated $3.5 billion over the next 15 years.

Federal Funding Opportunities

Federal funding options for the PRISM Project continue to be elusive. The DGS-TD has continued to meet with representatives of potential federal grant programs and other funding sources without much success.

The Emergency Medical Services Authority (EMSA) requested and was added as a participant to the PRISM Project as a result of the integral mission of emergency medical services in the public safety arena. The EMSA's participation in the project is funded under a $400,000 grant from the Office of Traffic Safety that receives its funding through federal highway funds.

As this report is being prepared, the DGS-TD is finalizing a consultant contract that will identify funding sources for the project including federal, state, grant, and foundation funding sources, among any others, which experts in the field may be able to identify.

The final report, under this contract, will be completed by April 13, 2001. While alternative funding sources may not be available for the current budget year, it may provide information for alternative funding for future years.

PRISM COST BREAKDOWN

Currently, funding of the PRISM Project provides for $1.81 million for FY 2000-01 and $1.57 Million for FY 2001-02 for the design and engineering work for the pilot project area. These allocations do not include funding for the construction of the system infrastructure, or end user equipment, which will be included in future funding requests.

Attachment A includes a complete cost breakdown for the 2000–01 through 2001–02 fiscal years identifying the costs of design and engineering including personnel, equipment, and consultant services to support those efforts.

ATTACHMENT A

Department of General Services
Telecommunications Division
PRISM Cost Breakdown

Item	2000/2001 (As approved in 2000/2001 BCP)	2001/2002 (As approved in 2000/2001 BCP)	TOTAL
DGS Staff Cost:			
Number of PY's	13.2	13.7	
Dollars	$834,000	$866,000	$1,700,0000
Existing Systems Costs			
PRISM Equipment Costs	$182,000	$0	$182,000
Consulting Services Costs:			
Internal	$18,000	$15,000	$33,000
External	$493,000	$479,000	$972,000
Other :			
General Expenses	$11,000	$17,000	$28,000
Facilities Operations	$26,000	$26,000	$52,000
Expendable Equipment	$60,000	$0	$60,000
Training	$16,000	$11,000	$27,000
Miscellaneous	$175,000	$162,000	$337,000
TOTAL	**$1,815,000**	**$1,576,000**	**$3,391,000**